Cui_Jingyi_Assgn05

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Problem 1

(a)

```
library(fOptions)
```

```
## Warning: package 'fOptions' was built under R version 3.6.3
```

```
## Loading required package: timeDate
```

```
## Loading required package: timeSeries
```

```
## Loading required package: fBasics
```

```
TypeFlag1 <- "c"
S1 <- 100
X1 <- 105
Time1 <- 0.5
sigma1 <- 0.325
b1 <- 0
r1 <- 0.01
result.GBS1 <- GBSOption(TypeFlag1, S1, X1, Time1, r1, b1, sigma1)
(summ1 <- summary(result.GBS1))
```

```
print(summ1@price)
```

```
## [1] 7.050845
```

```
char.GBS1 <- GBSCharacteristics(TypeFlag1, S1, X1, Time1, r1, b1, sigma1)
print(char.GBS1)
```

```
## $premium
## [1] 7.050845
##
## $delta
## [1] 0.4589033
##
## $theta
## [1] -9.008676
##
## $vega
## [1] 27.93595
##
## $rho
## [1] -3.525422
```

```
##
## $lambda
## [1] 6.508487
##
## $gamma
## [1] 0.01719136
```

(b)

```
newS <- 95
newResult.GBS <- GBSOption("p", newS, X1, Time1, r1, b1, sigma1)
(newSumm <- summary(newResult.GBS))
```

```
print(newSumm@price)
```

```
## [1] 14.92259
```

```
newchar.GBS <- GBSCharacteristics("p", newS, X1, Time1, r1, b1, sigma1)
print(newchar.GBS)
```

```
## $premium
## [1] 14.92259
##
## $delta
## [1] -0.6226226
##
## $theta
## [1] -8.082883
##
## $vega
## [1] 25.32956
##
## $rho
## [1] -7.461294
##
## $lambda
## [1] -3.963733
##
## $gamma
## [1] 0.01727138
```

Problem 2

(a)

```
Time2 <- 6/12
r2 <- 0.01
b2 <- 0.06
sigma2 <- 0.325
X2 <-seq(from = 85, to = 115, by = 1) # Strike price
S2 <- 100
Time3 <- 0.1/365
result.GBS3 <- GBSOption("p", S2, X2, Time3, r2, b2, sigma2)
```

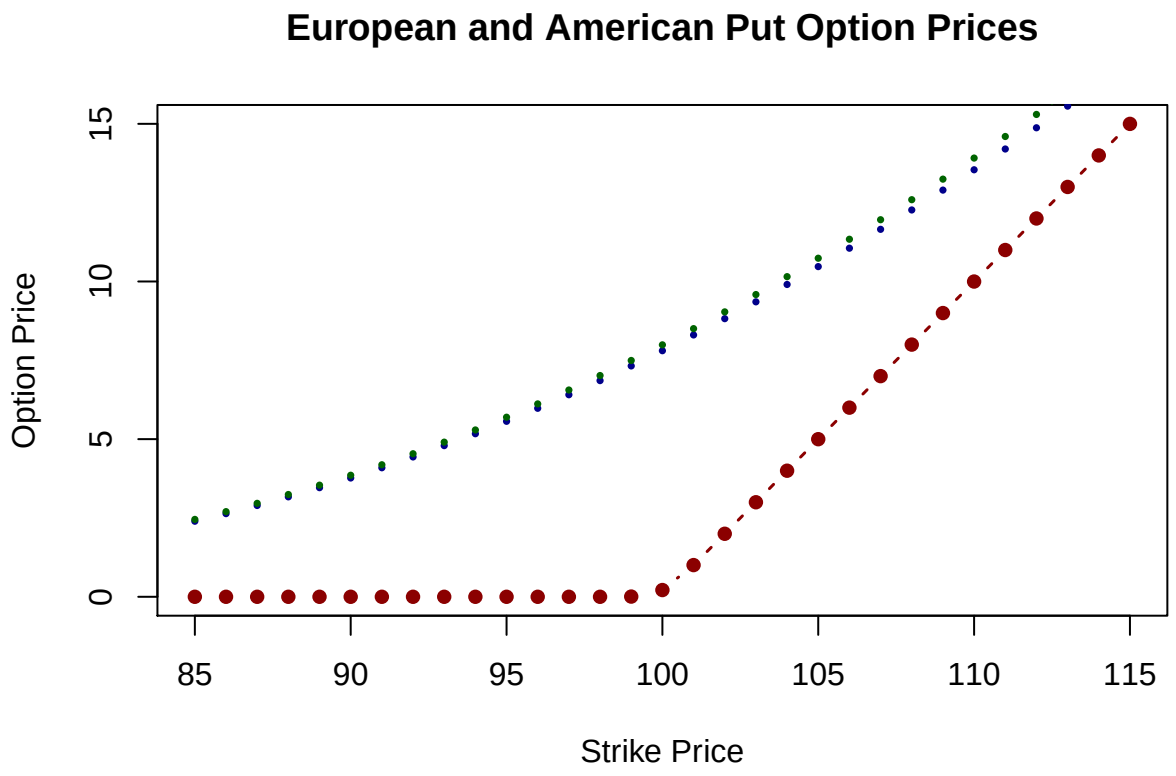
```
sum.Mat <- summary(result.GBS3)
matPrice <- sum.Mat@price
```

(b)

```
result.GBS4 <- GBSOption("p", S2, X2, Time2, r2, b2, sigma2)
sum.Mat4 <- summary(result.GBS4)
matPrice4 <- sum.Mat4@price
```

(c)

```
result.BAW <- BAWAmericanApproxOption("p", S2, X2, Time2, r2, b2, sigma2)
summ.BAW <- summary(result.BAW)
(BAW.prices <- summ.BAW@price)
plot(x = X2, y = matPrice, type = "b", col = "darkred",
     main = "European and American Put Option Prices",
     xlab = "Strike Price", ylab = "Option Price",lty=1, lwd = 1.5, pch = 16)
lines(x = X2, y = matPrice4, type = "b", col = "darkblue",
      lty=1, lwd = 1.5, pch = 16, cex=0.5)
lines(x = X2, y = BAW.prices, type = "b", col = "darkgreen",
      lty=1, lwd = 1.5, pch = 16, cex=0.5)
```



####(d)

```
# Option prices at six months to expiration are higher than those at time just before expiration.
# European and American put option prices are almost the same for each strike price.
```

Problem 3

(a)

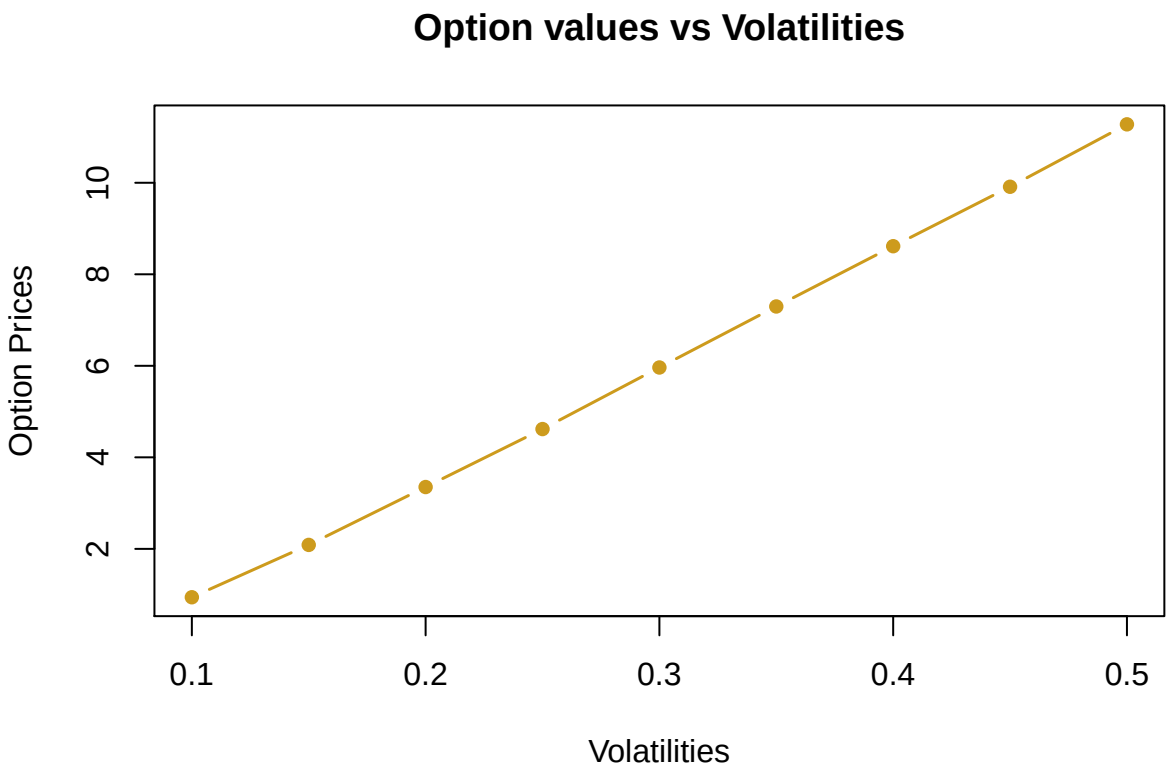
```
X3 = 95
S3 = 100
Time = 0.5
r3 = 0.01
b3 = 0
sigma3 = seq(from = 0.1, to = 0.5, by = 0.05)
prices <- vector("double", 0L)
for(sig in sigma3){
  put.JR <- JRBinomialTreeOption("pa", S3, X3, Time, r3, b3, sig, n=100,
                                 title = "American 6M Puts", description = "Varing options prices")
  prices <- c(prices, put.JR@price)
}
```

```
print(prices)
```

```
## [1]  0.9428535  2.0865623  3.3508769  4.6179423  5.9635867  7.2966257
## [7]  8.6133855  9.9126514 11.2764533
```

(b)

```
plot(sigma3, prices, type="b", col = 'goldenrod3', lwd=1.5, pch=16,
     main = "Option values vs Volatilities", xlab = "Volatilities", ylab = "Option Prices")
```



(c)

```
# As the volatilities increases, the option prices increase.
```